

Claims

What is Claimed is:

1 1. A process for milling copper metal from a substrate having an exposed copper
2 surface, the process comprising:
3 absorbing a halogen gas onto the exposed copper surface to generate
4 reaction products of copper and the halogen gas;
5 removing unreacted halogen gas from the surface; and
6 directing a focused ion beam onto the surface to selectively remove a
7 portion of the surface comprising the reaction products.

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1 2. The process according to Claim 1, wherein the halogen gas consists essentially of
2 iodine.

1 3. The process according to Claim 1, wherein the halogen gas is selected from the
2 group consisting of chlorine, fluorine, iodine and mixtures thereof.

1 4. The process according to Claim 1, wherein removing the unreacted halogen
2 comprises applying an electron beam scan to the surface and at an energy effective for
3 removing the unreacted halogen from the surface.

1 5. The process according to Claim 4, wherein the beam current comprises an energy
2 from about 500 to 3,000 picoAmps.

1 6. A process for focused ion beam milling multiple layers of a substrate, wherein the
2 substrate comprises an insulating layer in contact with an underlying copper surface, the
3 process comprising:

4 exposing the substrate to a noble gas halide within an enclosed chamber;
5 directing a focused ion beam onto a portion of the insulating layer and
6 removing the portion to expose the underlying copper surface;
7 absorbing a halogen gas onto the exposed copper surface to generate
8 reaction products of copper and the halogen gas;
9 removing unreacted halogen gas from the surface; and
10 directing a focused ion beam onto the surface to selectively remove a
11 portion of the surface comprising the reaction products.

1 7. The process according to Claim 6 wherein the halogen gas consists essentially of
2 iodine.

1 8. The process according to Claim 6, wherein the noble gas halide is selected from
2 the group consisting of XeF_2 , XeF_4 , XeF_6 , KrF_2 , KrF_4 and KrF_6 .

1 9. The process according to Claim 6, wherein the halogen gas is selected from the
2 group consisting of chlorine, fluorine, iodine and mixtures thereof.

1 10. The process according to Claim 6, wherein the focused ion beam comprises
2 gallium ions.

1 11. The process according to Claim 6, wherein removing the unreacted halogen gas
2 comprises applying an electron beam scan to the surface at an energy effective for
3 removing the unreacted halogen from the surface.

1 12. The process according to Claim 6, wherein the beam current comprises an energy
2 from about 500 to 3,000 picoAmps.

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